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ABSTRACT

This chapter reports the responses from 36 colleges and universities in the U.S.A. to an international questionnaire as part of a study to investigate the initiation and development of computer facilities in education. Data are presented under the headings: general development and scale of work, purposes of the project or unit, training of non-specialists and consultancy services, courseware development, and expectations of computer based learning. (VT)

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ONDERZOEK EN ONTWIKKELING VAN ONDERWIJS

meedeling 23

juni 1977

C.A. Hawkins

computer based learning 2

computer ondersteund onderwijs

2 U.S.A.–Verenigde Staten

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

a survey of the factors influencing its initiation and development

een onderzoek naar de factoren die de invoering en ontwikkeling van COO beïnvloeden

IR005 375

List of corresponding projects (36)

California Polytechnic State University
Computer Science Dept
E.E. Attala

Colorado State University
Computer Managed Learning System Laboratory
J.J. Watts

The Evergreen State College
Computer Services
J. Munro

Florida State University
Center for Educational Design
J.R. Merill

Gallaudet College
Office of Educational Technology
D.V. Torr

George Washington University Medical Center
Office of Computer Assisted Education
C.S. Tidball

Kent State University
Dept of Psychology
B. Downing

Medical College of Georgia
Systems and Computer Services
R.E. Pogue

Medical University of South Carolina
Office of Computer Resources
K.A. Duncan

MERIT Project
(Model for Evaluation and Recertification through Individualized Testing)
American Board of Internal Medicine
W.G. Harless

Northwestern University
Computers and Teaching
J. Schuyler

Ohio State University College of Medicine
Division of Computing Services for
Medical Education and Research
R.E. Pengov

Oklahoma State University Technical Institute
D.H. Seeger

The Pennsylvania State University
Computer Assisted Instruction Laboratory
K.A. Hall

Purdue University
School of Pharmacy
S. Deiss

Southern Illinois University School of Medicine
Division of Health Science Information Systems
R.C. Comer

Stanford University
Institute for Mathematical Studies in the
Social Sciences
P. Suppes

Texas College of Osteopathic Medicine
J. Swain

Tulsa Junior College
D. Hamlin

University of Akron
College of Education
J.J. Hirschbuhl

University of Arizona
Dept of Physics
J.W. Robson

University California, Davis
Computer Aided Instruction Group
D.R. Ojakangas

University of California, Irvine
Physics Computer Development Project
A. Bork

University of California, Los Angeles
School of Medicine
Curricular Affairs and Educational Research
B.M. Wenzel

University of California
San Francisco
Computer Center
M. Kamp

University of Connecticutt
Health Center
R. Rippey and R.G. Votaw

University of Evansville
Academic Computing Services
D.K. Jones

University of Illinois
CERL (Computer-based Education Research Laboratory)
B. Sherwood

University of Kentucky
College of Dentistry
T. Smith

University of Michigan
U-M CRLT
K.L. Zinn

University of Michigan School of Dentistry
Dept. of Educational Resources
D.D. Starks

University of Missouri School of Dentistry
Office of Instructional Services
D.E. Tira

University of Pittsburgh Eye and Ear Hospital
Dept of Ophthalmology
P.G. Rehkopf

University of Toledo
Academic Computer Services
H. Standley

University of Washington School of Medicine
R.E. Cutler

Western Washington State College
Computer Center
J.L. Hayes

I. GENERAL DEVELOPMENT AND SCALE OF WORK

U.S.A. Table 1 Base of operations

	Numbers of projects	Comment
Academic Faculty	9	Opthalmology, medical school, 3 x dental medicine, physics, engineering, education
Computer Centre	11	
Committee	10	Committees usually answerable to a Dean or University Vice President, thence to President. 1 - American Board of Internal Medicine
Other	11	Mostly independent units, university wide service. Several part of Departments of Educational Resources.

The number of independent units is higher than in the other countries surveyed.
Formal high level committees are also more common.
The range of supporting faculties is similar to other countries.
Many mulit-faculty projects are coordinated and organised from a computer centre.

U.S.A. Table 2 Main stimulus to establish unit

(several multiple entries)

	Numbers of projects	Comment
Administrative	14	Several - important initially, .. led to establishment / broad institutional approach / resources.
Staff initiative	21	Many stressed importance of initiative from 1 or at most 2/3 staff members. 1 clinical medicine department - relieve teaching load (Pittsburgh) 1 group experimental scientists (PLATO).

cont.

Other	22	12 - general pressure of innovation and modernisation 3 - funds were available 3 - computer / CAI available, free for a trial period 4 - particular teaching problem - heavily loaded staff in clinical medicine - need for performance based recertification procedures for internists - move to individualized curriculum

U.S.A. Table 3 , Main sources of innovative effort

(some multiple entries)

	Numbers of projects	Comment
Administration	16	
Committee	2	
Faculty group		
computer	4	
education	5	1 - centre for teaching professions
subject department	15	5 - Medicin[illegible] 1 - Maths 2 - Physics 1 - foreign 1 - El engineering languages 1 - Physiology 1 - English 1 - Biology 1 - Psychology 1 - Pharmacy
unspecified	3	
Individual or very small inter-faculty group (2/3)	11	Several - computer science - Maths, Maths ed. - foreign laguages - Economics - business administration - Philosophy - Psychology

Of those perceiving the main source of innovative effort from administration, many placed this at a high level - several Univereity President, Vice President, Dean of Academic Affairs, Medical Dean. Two indicated importance of high-level administrative support following individual initiatives.

There are many multiple entries where credit is attributed to administration or a faculty group but the project, particularly in its early stages, was "essentially a one man effort."

U.S.A. Table 4 , Staffing

Number of personnel totalled over all projects		Comment
Educational psychologists	19	
Educationists (other university subject matter specialists)	21	e.g. - research methodologist - evaluation, testing - audiovisual experts - staff from educational resources - educational technologists - counselor plus several unspecified behavioral scientists
Computer scientists	52 - 60	
Professors	more than 65	6 - Maths 2 - Statistics 2 - Engineering 3 - Electrical Engineering 7 - Physics 4 - Chemistry 1 - Biochemistry 3 - Biology 4 - Science/ Basic Science 25 - Medicine 2 - Health Science 1 - Physiology 5 - Pharmacy Depends on current programme - 6 projects
Students / graduate assistant	about 85	2 - 'hard' Sciences 3 - Engineering 15 - Medicine 2 - Dentistry 4 - Computer science 4 - Education 1 - Physiology 1 - Philosophy 1 - Psychology 1 - foreign languages 1 - Business studies plus 50 or more unspecified subjects (replies such as 'various', 'typically 2 at any time', etc.)

These figures represent full time commitment. Faculties are regularly involved on a part time or informal basis with particular programmes. The number of students and graduate assistants is rather large and somewhat indeterminate; probably, a rapidly changing group.

U.S.A. Table 5 , Direction of Projects

Projects with a steering committee - 17
with no steering committee - 20

Size of committee

number of members	
1 - 4	6 projects
5 - 9	8 projects
10 - 14	3 projects

Representation on steering committees

1. Administrators

President / Vice President	2
Provost / Dean	6
Assistant Provost / Dean	3
Coordinator Interdisciplinairy studies	1
American Board Internal Medicine	5
Urspecified	17

2. Heads of Departments

Computer Science / Services Directors 5
One each reported from :
Natural Sciences, Physical Sciences, Physics, Engineering, Environmental Studies, Genetics, Sociology, English, Psychology, Microbiology, Library Services.
1 - WISP representative
2 - projects do not specify departments

Computer Scientists and Computer Services

Either Computer Services or combined departments.
No separate representation for computer scientists reported.

Directors	9
other staff members	8

Educationists and Educational Technologists

Evaluational Psychologists	3
Educational Resources	3

University teachers

6 projects report

1 - all Medical School Departments
1 - all School of Pharmacy Departments
2 - 4 faculty from unspecified departments
1 - Physics Department, members unspecified
1 - Biochemistry, 1 member.

Other

2 projects report student representation.

Projects with no steering committee

1 project reports 'no committee as yet, but one about to be formed'
1 project reports 'laboratory run by Director and Assistant Director, who establish advi. ry group which changes with the projects op ating'.
1 currently under Director of Computer Centre.
Most others report projects run by Director (sometimes with Assistant Director) who reports directly to high level administrator (Dean / Vice President etc.)

A few projects located in only 1 teaching department are directed by Department Committees.

U.S.A. Table 6 Main types of resistance

('No' = explicit response, not merely unchecked.)

1.

	Yes	Partially	No
Cost	21	-	1

Comments

2 - new projects

- 'particularly, because we access other institutions and so pay service and telecommunications'
- 'we had to justify the high initial of PLATO at least to ourselves'

4 - long established projects

- 'still a problem'
- 'funds for development a problem'
- 'project now supported as part of university budget'

other projects

- 'greatest problem was money for equipment'
- 'not excessive cost, but any cost is a problem'

U.S.A. Table 6 (cont.)

2.

	Yes	Partially	No
Lack of knowledge	21	1	2

Comments

- 'an educational programme for faculty was needed'
- 'few faculty members knew what was involved with CAI'
- 'faculty jumped in without realising what it takes to write a computer program'

several - 'the biggest factor'.

3.

	Yes	Partially	No
Lack of confidence	15	2	2

Comments

- 'suspicion that it's just a fad'
- 'No - those who were confident use our resources to capacity'
- 'we started with plenty of confidence in the potential of CAI'.

4.

	Yes	Partially	No
Inertia	16	2	1

Comments

- 'many staff members are set in their ways, with no incentive to change'
- 'No - but less in Clinical Medicine because of desire to reduce teaching burden'

5.

	Yes	Partially	No
Lack of time to reconstruct courses	17	-	1

Comments

- 'although much faculty effort is [illegible] to curriculum development, that doesn't mean they are prepared to learn about CAI'
- 'difficulty in finding time rather than reluctance'
- 'so it is best if faculty gives the information core and other team members put it into a package'
- 'without some incentive system they won't take time to re-do a package'.

U.S.A. Table 6 (cont.)

6.

	Yes	Partially	No
Lack of time learning techniques	13	1	1

Comments

- 'to overcome this CAI staff do all programming'
- 'some will not agree to a detailed set of behavioural objectives for a lesson. There is no deep interest in the lessors, lesson design and authoring is left to the graduate assistants'.

7.

	Yes	Partially	No
Other	4	-	-

Comments

2 - lack of incentives
1 - lack of available terminals
1 - inadequate resources e.g. programmes to develop indigenous materials.

Further comments

'It has been a matter of time for teachers to become aware of the possibilities, and then find money to accommodate the increased load when students are brought on line'.

'We have found it most effective to begin working with particular faculty members, developing programs and other materials, and then letting the pressure build up from these faculty members convincing the larger university community'.

One project reports 'no resistance'.

U.S.A. Table 7 Main sources of resistance

1.

	Yes	To some degree	No
Costs	9	-	3

Comments

2 - 'resistance expected, understandable and reasonable / resistances appropriate'
- 'university thinks of CAI as an add-on cost'
- 'university can only think in terms of the biennium'
- 'continued operational costs after project established as a production facility'
- 'it's not easy or cheap to do it well'
- 'entire administration cost-sensitive'
- 'cost dominated State Legislature'
- 'not really a resistance - National Science Foundation Funds'.

2.

	Yes	To some degree	No
Higher priority of other projects	5	-	2

Comments

3 - research has higher priority
- Medical School, clinical patient load
- priority to 'black study' programs

3.

	Yes	To some degree	No
Other external sources	4		

Comments

- fear of failure
- general expansion
- fear of technology
- ignorance at all levels

4.

	Yes	To some degree	No
Other pressures on teachers	21	-	-

Comments

2 - teaching load
1 - work with graduate students
2 - 'publish or perish' and CAI doesn't count
2 - research
1 - clinical medicine

5.

	Yes	To some degree	No
Anxiety of displacement	2	2	4

6.

	Yes	To some degree	No
Other	5	-	-

Comments

2 - 'few care in a situation where there is no recognition, promotion or tenure associated with authoring CAI'
- 'it takes as much time to create a PLATO based course as to write a text book. Few teachers have such a commitment - typically, one per major department. (Other colleagues will happily use the materials then produced, however.)'

cont.

- 'ignorance - not only in terms of what can be done with computers - also, how long it takes to accomplish it, how much support it requires, how best to use it'.

U.S.A. Table 8 Obstacles to teacher cooperation

1.

	Yes	We don't require this	No
Learning a computer language	9	7	3

Comments

- 'University teachers should not have to learn a computer language in order to make use of CAI'
- 'Also, many teachers look down on programming as a menial task'

2.

	Major problem	Minor Problem
Learning to construct self-instructional packages	18	4

Comments

- 'time consuming'
- 'few faculty think in these terms, and those that do think in terms of very linear lessons'
- 'specifying the details of the scope and the sequence of the instructional materials and the appropriate interactions between the materials and the students is the most difficult part of developing computer based learning materials'
- 'somewhat a problem, but resources do exist to solve it. Faculty won't take time to explore alternatives. Name one university where incoming faculty are <u>required</u> to take part in a teacher training program'.

3.

	Yes	No
No incentive	25	2

Comments

- 'problem because of typical university award structure'
- 'productivity incentives should be offered'
- 'we have overcome this by getting the Dean to give recognition to self-instructional materials for promotion and tenure'.

4.	Yes	To some degree	No
No training or follow-up	5	2	4

Comments

- 'training is not a problem, but follow-up is'
- 'there must be consultants'
- 'no dollars for it'

5. Other issues

Comments

2 - main problem is the lack of resources to provide extensive technical assistance e.g. to overcome problems 1 and 2. Growing austerity makes this more difficult.

2 - teachers want very specific materials, but are usually insufficiently skilled or motivated to write their own. Faculty don't have to learn a computer language to use existing materials.

- CAI is not a proven medium
- lack of good examples
- lack of relevance of good examples to educational needs in a given situation
- inertia of teachers is the main problem
- moving CAI materials into the curriculum is the main problem. Many are satisfied to use them as adjunct materials, but this is inadequate to bring about the necessary changes.
- I believe the major obstacle is intimidation by the machines. Once educators learn to interact with a terminal, the experience becomes fun.

U.S.A. Table 9 Transfer

Use of materials from other projects before indigenous courseware was developed; success with materials from elsewhere and adaption problems.

		very good	fair/ mixed	little	to early to say
Materials used on considerable scale	25	9	11	4	1

Problems

(Very) good success - 9

- lack of variety in materials
- many well received, some not so well prepared
- some modification desirable, faculty usually want to adapt to own needs

cont.

- PLATO great, especially Organic Chemistry
- some success with PLATO courseware
- Russian, Maths Drill from Stanford very successful when properly modified to our system
- some materials irrelevant and some gaps
- software problems - programming errors or poorly written instruction.

Fair/mixed success - 11

3 - not well received because materials didn't fit our objectives
4 - it's hard to find good materials
- many programs poorly developed by poorly trained faculty. They appear to be developed only to show productivity.
- professors did not feel they could control the materials well enough
- we often could not use PLATO materials when we wanted to
- lack of time for students - their schedules are very tight
- it demonstrated high costs!
- it demonstrated what could be done
- special, local functions developed at source would not run on our computer
- media (teletype)
- system reliability of PLATO low early on, O.K. now, but this had its effect
- our local system is not ready for CAI - we are fortunate to have access to PLATO

Very little success - 4

- most examples in our field use computers as page turners
2 - nature of the material. Didn't fit our objectives.
- disastrous BASIC lessons because of poor documentation and unstable local version of PLATO

To early to say - 1

- it was difficult to get all the supplementary material and functions necessary.

		success	little success
Limited use of materials from elsewhere	2	1	1

Problems

Success

- O.K.

Little success

- most examples in our field use computers as page turners

No use of materials from elsewhere - 8

Problems

3 - none available when we started !
- almost no one uses graphics terminals, which we consider the minimum requirement. Our system (PLATO) is so powerful that we can "reinvent the wheel" at very low cost in those few cases where we come across an interesting idea elsewhere.

No replies from 7 projects.

U.S.A. Table 10 Use of own materials elsewhere, level of adaptation and success

		level of adaptations			success		
		none	some	not known	good	fair/ mixed	not known
Yes, large scale	15	5	9	1	8	4	3

Comments

Level of adaptations

None

- PLATO - very heavy usage elsewhere

Some

- modification to fit local software for input-output statements
- translation from our own courswriter/PL/C language (no longer in use)

Success

Good

- PLATO - problem of transportability eliminated by building a network
- mostly for demonstration purposes
- PENN state - courses still running many institutions, often no adaptation

Fair/mixed

- mixed - a few quite positive

Not known

- think good, not much feedback.

		level of adaptations			success		
		none	some	not known	good	fair/ mixed	not known
Limited	3	2	-	1	1	1	1

Comments

Success

Not known

- too soon to tell

None	10

Comments

Plus no replies from 7 projects
In most cases "none" is implied but a few (e.g. Suppes, Stanford) are known to lend materials to other projects.

Note
These figures indicate a much more positive view of the success of transfer when viewed by the lender rather than (previous table) by the borrower.

U.S.A. Table 11 Now that the project has its own materials to what extent are others used?

Yes	23

Where from? (usually several respondents for each)	Level of adaptation prepared to make?
computer curriculum coorporation	
Univ. of Illinois Other medical schools Other health science schools	- only management details are required - as much as needed while economically worthwhile vs developing own from scratch 4 - if we like the content, we'll re-program a teaching module to run on our own system
Mass. Gen. Hosp. Ohio State Univ.	- transported and programmed for us on local computer

(cont.)

East Texas State Univ. Simon Fraser Univ. of Akron Kansas State Univ.	- must be written in Coursewriter III
PLATO, other users of PLATO network	- whatever necessary and permitted by the author - depends on individual professor - mostly, no adaptations, but few have transferred whole lessons to the local system - rather than adapt, we suggest improvements, or how to make more modular, to fit our curriculum needs - whatever necessary
4 - 'wherever we find something of interest'	1 - moderate reprogramming to make materials compatible with our computer 2 - if we like it, we'll spend considerable time on it 1- total - we've written several translator programs and handle translations for other institutes (Hayes).

No	5

- because of portability problems.

No replies from 7 projects.

Although not a large number of projects using materials from elsewhere before development of their own will concede a good level of success to these, almost all continue to use other's materials. Presumably they have become more selective in their sources.
Several of those listed in this table were cited by several others projects.

Tables 12 & 13 Length and stability of establishments

Those projects that were described in sufficient detail are reported below, under the headings 'long established' (= pre 1970), 'mid-term' and 'newly established' (about 2 years old at time of reporting).

Long established	Prognosis
1. Hayes (W.Washington) 1968 Center started 1969 CAI began 1 hour per week 8 terminals on IBM 360/40 1976 switched to INTERDATA 7/32 mini computer	permanent
2. Merrill (Tallahassee) 1963 Council for Instruction Awards Program 1968 Group initiated to help faculty	permanent
3. Schuyler (Evanston) 1968 Lingo project 1972 Computers and Teaching founded for 2 year period 1972 Hypertutor developed	permanent Maybe CAI assimilated in departments and will continue even if project doesn't.
4. Sherwood (PLATO) 1. Late 1950, Sherwood observed that computers were used for administration and research but not for instruction. 2. Broad based committee under Dan Alpert in Coordinated Science Lab. to study this. 3. This disparate, ecumenical committee reached no conclusions. 4. Finally Alpert asked electronics engineer Bitzer to study the problem. 5. 1959 Bitzer produced a plan in a few days and began implementing it. 6. 1960 Bitzer could demonstrate PLATO I with a graphics terminal. 7. Project moved out of coordinated science lab and became CERL.	It will always be a major part of instruction in our university.
5. Suppes (Stanford) 1963 began courses in Slavic languages, etc. Current concentration is on logic and set theory.	Into the indefinite future.

(cont.)

6. Zinn (U-M CRLT.)	Prognosis
1. Personal research interest 2. Faculty interest 3. Benefits in College teaching 4. Grants for specific development projects.	Permanent

Mid-term	Prognosis
1. Cutler (Washington Seattle) 1972 WISP began with entering medical students. Computer based education part of that department.	May become permanent
2. Downing (Kent State) 1. Funded for remedial education 2. Connected to Univ. of Akron. IBM system. 3. Staff established to examine existing and create new courseware. 4. Installed 14 time-sharing terminals, own computer. 5. Own materials on own computer.	Probably permanent
3. Duncan (South Carolina) 1. New Dean of School of Dentistry had capital funds to spend on dental education. 2. Offices of Computer Resources formed, reporting to Dean. 3. Responsible for general educational computing + CAI/CMI, working with faculties in all departments.	Permanent
4. Hirschbuhl (Akron) 1971 Hirschbuhl hired 1972 CAI started with 5 terminals 1973 15 terminals, now CRTs 1974 Network begins with 2 participants 1975 10 participants.	Indefinitely
5. Swain (Texas) (Osteopathy) 1. 1971 trial basis. 2. Moderate success, overwhelming student response. 3. Continued and budgeted each year.	Indefinite

	Prognosis
6. Tira (Kansas) 1970 Installation of system 1971 First service program 1975 Offer 13 CAI programs, 12 developed in house, plus 3 in development.	Permanent
7. Torr (Gallaudet) Liberal Arts College for the Deaf. Office of Educational Technology includes computer, ETV, film, Instructional Materials Research and Development, Print Shop. Unit supports teachers interested in CAI	Permanent and evolving

Newly established	Prognosis
1. Deiss (Purdue) (Pharmacy) 1. Tried numerous alternatives. 2. Eventually ordered a PLATO terminal to try it out. 3. PLATO so superior to everything else available, it more than makes up for difference in cost.	Indefinite
2. Hamlin (Tulsa) 1975 Established with funds from Technical-Occupational Program. February-equipment purchased and personnel hired. June-went into production.	Permanent
3. Jones (Evansville) Still in first year of operation. Tried similar operation 3 years ago, but faculty were not ready. Now is a better time.	Expect to decide within 1 year if to continue
4. Rehkopf (Pittsburgh) (Ophthalmology) 1. 1974 Decision to investigate CAI 2. " Look at CAI available 3. 1975 Institute CAI with outside materials 4. " Evaluate program effectiveness 5. Demonstrate program teaching effectiveness 6. Development of own programs.	Expect it will be indefinite

(cont.)

U.S.A. Tables 12 & 13 (cont.)

	Prognosis
5. Rippey (Univ. of CT) (Health Centre) 1. New school, 8 years old, CAI established 2 years. 2. Votaw originally interested in joining National Library of Medicine Network (now HENUG). 3. PLATO added after 1 year. 4. Considerable systems development on UNIVAC 1106 concurrently.	Severe curtailment anticipated for budgetary, not educational, reasons
6. Robson (Tucson) 1974 Spring PLATO demonstration 1974 August CBI lab established.	Feasibility project. We hope major operational program will begin within 2 years
7. Ojakangas (Davis Calif.) 1. Started 1974, .75 F.T.E. Electr.Eng. 2. Added .75 F.T.E. to assist faculty graduate students. 3. Much effort by departments to create own materials with CAI group support.	Review in 6 month cycle

U.S.A. Tables 14-15-16 Materials available and usage

(Projects reporting 'few', 'in development', 'low terminal hours', 'see publications', or totally borrowed materials not summarised.)

Project	No of lessons, hours etc.	Subjects at tertiary level (other levels also, 'all')	Other computer based materials	Regular instruction student terminal hrs
d'Arezzo Rhode Iland	many	all	test batteries Data bank	2100 hrs/wk
Attala Calif. P.S.U.	20 hrs	Computer Programming- BASIC, Cobol, PL/I, FORTRAN		20 hrs/ student/ course
Bork Irvine	40	mostly physics dialogues	on line information systems DIALOGS and BROWSE	250 hrs/wk
Deiss Purdue	30	medicinal chemistry, clinical pharmacy, biopharmaceutics, physical pharmacy, bionucleonics	programs to : - schedule students - evaluate studs opinion, studs preview grades, demonstration	

Project	No lessons	Subjects	Other	s.term.hrs
Downing Kent State	70	Math, Chemistry, Psychology, Statistics, Basic English	simulations 4 sets test batteries 1 data bank on Ss	300 hrs/wk
Duncan Sth Carolina	7 units	Dental Education	grade keeping system, clinical management, data bank of review questions	5 hrs/wk
Hamlin Tulsa	8 major courses	Computer operation, Cobol, Music appreciation, Accountancy, Nursing		40 hrs/wk
Hall Penn.State	many	was teacher ed. now nursing	test administr.	
Harless Merit			20 CASE's = simulations of patients with internal med.probl.	
Hayes W.Wash.			1 stats. package test constr.	2000 hrs/yr
Hirschbuhl Akron	45	all, most	2 test item banks	100 hrs/wk
Kamp S.F.Calif.	15	Pharmacology, Pharmacy, Nursing, Programming		300 hrs/yr
Merill Tallahassee	many incorp. AV + CMI/CAI	Science	test battery data bank	35,000 hrs/yr in CMI alone
Munro Evergreen	25	Chemistry, Math, Physics, Logic, Engl. compos., Comp.program.		150 hrs/wk
Okajangas Davis Calif.	20	Nutrition, Genet. Engin., Stats., Physics, Math, English, Wildlife, Biology, Modelling, Simulation	2 test batts 1 data bank human physiol.	1200 hrs/mnth
Pogue Georgia	6 crs.+ access to PLATO medical schools cited above	Medicine, Dentstry Continuing Ed.	6 test batts	8000 hrs/yr

Project	No lessons	Subjects	Other	s.term.hrs
Rehkopf Pittsburgh	10	Medical School, Residency		8 hrs/wk
Rippey Farmington + several others e.g. Comer, Swain, Cutler	400 + as below many	Access PLATO, UNIVAC + as below Med.courses from Mass.G.H., Ohio State, Univ. of Illinois	computer based test items	1000 hrs/yr about 50 hrs/ student/yr
Schuyler NW	100	Linguistics, CAI, Ed.psychology, Pediatrics, Dermatology		400 hrs/ quarter
Seeger Okla	35	Math, Computer Progrm., English, Accountancy, Chemistry	computer console simulation	8 hrs/day
Sherwood Urbana	4000 hrs.	all, most	test batteries data banks	not reported
Smith Kentucky	15	Dentistry		not reported
Suppes Stanford	many incl. complete courses	70 hrs Introduct. to Logic, 50 hrs Axiomatic Set Theory, Old Church Slavonic, Bulgarian, BASIC		not reported
Tidball	10 + 100 from Health Eductn Network	Medical School	interactive stats. packages comp. utility programs	not yet in regular instruction
Tira Kansas	13	Dental	dental glossary	77 hrs/wk
Torr Gallaudet	many	Stanford Russian Course + Algebra, Arithmetic Chemistry, COBOL, German, English pattern practice	test battery, Algebra	not reported
Zinn U-M CRLT	50	nearly all areas incl. Physics, Psychology, Histry Dentistry, Educ. Chemistry, Polit. Science, French, Law, Libr.Science, Biology, Sociology Medicine, English	3 test batts 4 data banks 2 paper patients 12 simulated labs 18 simulated mgmt 7 problem solving	1000 hrs/yr

U.S.A. Table 17 Factors contributing most to success

In many cases several comments from different respondents have been summarized under one paraphrase or group of statements.

Technical and style

1. Quality of programs pedagogically.
2. Relevance of programs - they treat important problems.
3. Variety of available materials.
4. High degree of interaction.
5. Graphics.
6. Terminals not in a separate location.
7. Excellent time sharing system to use
   Your own computer is essential.
   General purpose cost-effective mini system.
8. Separate the system from pedagogy. Build a system that is sufficiently flexible for teachers to use any pedagogy.
   Flexible authoring system and flexible software approach.
9. 'Hard' scientists and engineers rather than educational psychologists will let the teachers define what to build so that the system does what they need, rather than impose a system.

Organisational/Sociological

1. My own determination and knowledge.
2. Able group technically trained personnel.
3. Enthusiasm and dedication of CAI group.
4. Strong central direction.
5. Support by top level administration.
6. 'Hard' funding.
7. Success by some faculty, making a core group.
8. Student interest.
9. Low key approach.
   We have gradually built up an enthusiasm for the use of CAI as a tool.
10. Individualized curriculum.
    Computer centre support.
11. Dedication to terminal system dependability within the whole computer centre.
12. Relation to faculty research use of computers.

External factors

1. Innovative, new institution - Exciting educational climate.
2. Availability of extra-mural financial support gave the unit some independent status and prevented it from being initially smothered by hostile local conditions.
3. Outstanding work of PLATO development group, University of Illinois.
   If it had not been for the resources of the PLATO system, I would have had to sit down and design something like it.
4. Available equipment, money, free access to time-shared computer.

II.1 U.S.A. Purposes of the Project or Unit

Many "objectives" which were most obviously means rather than ends. e.g. "obtaining funds" have been excluded from the summary. Several which remain have the character of means, but if the ends to which they are directed are clear, they have not been rewritten.

The reported objectives have been classified under the following headings.

1. Research 2. Educational 3. Financial 4. Technological
5. Implementation/Innovation.

1. Research

1. - Investigate general applications of computers to instruction.
2. - Provide a setting for investigating and developing CAI.
   - Investigate the feasibility of CAI as a regularly available educational tool.
3. - Research into the effects of CAI.
   - Ditto for self produced and off-campus materials.
   - Research into the effects of CAI on learning and motivation.
4. - Research into new methods in CAI
   - Research into new areas for CAI in non-traditional education (e.g. adult education).

2. Educational

1. Goals of a general nature, providing an overall framework to activities.

1. Improve education with this powerful tool.
2. CAI is a subsystem in a larger instructional system, an expensive component which must be appropiately exploited.
3. CMI is essential to the establishment of a individualized curriculum.
4. Supplement and subsitute for the classroom environment.
5. Develop a total instructional system to include
   - diagnostic testing of skills
   - analysis of courses to determine more appropriate computer augmentation
   - remedial materials.
6. Promote adjunct use of CAI - simulation, problem solving, etc.

2. Specific, concrete educational goals of general application

1. Shorter time for students to complete courses.
2. Salvage students in academic difficulties.
3. Allow students to proceed at their own pace.
4. Allow students to study at whatever time they choose.
5. Free faculty to permit them more face-to-face teaching, and individualize instruction.
6. Improve educational success of every student.

3. Curriculum materials

1. Develop curriculum materials.
2. Medical - diagnosis and prescription (instructional).
3. Dental simulation.
4. Drill and practice for language teaching.
5. Remedial math and English.
6. Computer programming to be taught wholly by CAI.

4. Testing and CMI

1. Self-assessment by students.
2. A computer-based final examination system using a randomized item bank.
3. Medical - individualized examination to evaluate clinical decision making.
   - recertification valid - i.e. : it measures actual performance
   - feedback to medical practitioners on their performance.

3. Financial

Few of these were reported. Where they were, financial goals were associated with general system goals..

Deiss - 'My ultimate long-range purpose is to provide a means where students can receive academic training in the home or on the job at a greatly reduced cost, in less time, self-paced, and with proper accreditation.'

Sherwood - 'Get graphics oriented, fast response instructional, computational, information and communication services into all schools, homes and offices at a cost of $ 1000 per year per terminal as a start!'

Schuyler - 'To create and maintain an inexpensive CAI system (HYPERTUTOR) made available to other universities.'

4. Technological

1. Ease of system use by students.
2. Ease of altering materials by authors.
3. Appropriate use of computer with material that lends itself to CAI.
4. Some student control over presentation.
5. Fast response time.
6. Portability of system and materials.
7. System reliability.
8. Development and maintenance of an interactive system.
9. Enrichment of terminal sites - teletypewriters + AVA and CRTs.
10. Develop PLATO system (by user).
11. Evaluate best use of PLATO, PLANIT, IDF, Coursewriter III.
12. System to facilitate collection and analysis of data on student performance.

5. Implementation/Innovation

1. Educate faculty in the use of CAI.
2. Motivate faculty support of CAI and its regular use in the curriculum.
3. Consultation with faculty to ascertain their uses for CAI.
4. Support faculty as authors.
5. Assist faculty in acquiring materials.
6. Increase faculty awareness of the CAI unit's capabilities.
7. Increase faculty awareness of off-campus sources.
8. Increase computer literary of staff and students.
9. Hands-on authoring courses.
10. Permanent establishment of CAI/CMI in instruction.
11. Development of a user manual.
12. Development of guidelines for the evaluation of CAI.
13. Survey of existing courseware.
14. Facilitate faculty development of CAI.
15. Facilitate cooperative interdepartmental use of CAI.
16. Establishment of CAI classrooms at strategic campus points.
17. Train a critical mass of students and faculty in the use of the resources.

Note

Some projects reported no objectives, and some very few. Many responded in more than one of the above categories, although there was usually a tendency to concentrate. The objectives reported here are generally detailed, production oriented, realistic and confidently expressed, and although there was a shortage of research type objectives, several projects report far-reaching overall objectives in which research and development objectives are necessarily implied.
Conflicting opinions will be seen - e.g. contrast between "total system", and "adjunct use", and role of educational technologists.

U.S.A. II,2a. How objectives were arrived at

- My own understanding of our shoddy educational system. (1)
- Assessment of requirements of our educational environment. (2)
- Discussion by CAI group. (4)
- Group consensus. (1)
- Committee decision. (1)
- Administrative consultation. (1)
- In conjunction with grant agency. (2)
- Looked at other systems. (1)
- Following pilot study. (1)
- Just evolved. (1)

U.S.A. II.2b. Which of the reported objectives are considered to be of most importance?

1. Research

- Effect of CAI on student motivation.

2. Educational

- Remedial programs.
- CAI in non-traditional education (adults).
- Adjunct use of CAI (simulation, problem-solving).
- Self assessment.

3. Financial and systems

- HYPERTUTOR
- Develop PLATO system (by user).

4. Technological

- Student ease of use, smooth operation for students.
- Student control over presentation.
- Ease of authoring and editing.
- System reliability.
- TV technology.

5. Implementation/Innovation

- Help faculty produce materials.
- Expand available courseware library.
- Expand network.
- Liaison with faculty.
- Coordination of efforts.
- Introduction of CAI/CMI into the curriculum.
- Familiarize and train critical mass staff and students.

U.S.A. II.3. Rated importance of suggested reasons for developing computer based learning

	High	Medium	Low	Comment
research on student learning	2	7	15	- not yet - by us - perhaps
individualisation of instruction	15	6	3	- main use - to some extent - important in a school of nursing
mastery learning	12	4	8	- not likely
evaluation of course elements	3	8	13	- perhaps

(Cont.)

	High	Medium	Low	Comment
organisational change	4	4	16	- not likely - not explicitly considered here
increase capacity of educational provision	6	11	7	- not yet - not until much more course-ware is available
increase effectiveness of educational provision	12	7	5	- most important - increase retention of knowledge
decrease student learning time	9	5	10	- unlikely
decrease teachers' teaching time	1	4	19	- not demonstrated by us - unlikely - reduce time in classroom
decrease teachers' record keeping time	5	4	15	- potential - perhaps - definitely

Other possibilities

- Increasing faculty instructional awareness (Tira)
- Reduce cost of instruction (Jones)
- Increase problem solving skills (Bork)
- Increase 'intuition' (Bork)
- Remedial education (Downing)

Two respondents, Deiss and Merill, differentiated between CAI and CMI. Rank order was within one rank order place on a scale of 1-10, except that both placed reducing teachers' record keeping time high for CMI, low for CAI; and Deiss also placed reducing student learning time high for CAI, low for CMI.

U.S.A. IV. Training of non-specialists and consultancy services

1. Courses

	Yes	No	Not relevant
Courses in author languages	16	8 (3 'not yet')	2 (because not required)

'Yes' from :	students, or students per course; course hours
Attala	set of 3 courses, author language and instructional design, each 30 hours
Comer	at University of Illinois (TUTOR)
Cutler	available; few students come
Deiss	School of Education. PLATO oriented
Hayes	10 students for 10 hours
Hirschbuhl	70 students, 7 hours per day for 2 weeks (including instructional design)
Jones	12 students, 30 hours
Kamp	5-15 students, 20 hours - PILOT
Ojakangas	16 hours
Rippey	2 courses; TUTOR, 10 students, 2-7 hours; UIL enhanced, 8 students, 8 hours
Robson	50 students, 20 hours
Schuyler	40 students per quarter, 24-40 hours
Seeger	80 hours course
Smith	20 students, 8-10 hours
Tidball	several x 10 in past year, also by CAI (hours not reported), also instructional design
Torr	short workshops about to be given - also instructional design.

	Yes	No	Not relevant
Courses in instructional design	10	15	1

'Yes' from :	students, or students per course; course hours
Attala	see above
Bork	informal courses for beginner authors
Deiss	30 students, 45 hours (3 hours x 15 weeks)
Duncan	workshops in instructional design all invited, but few participants
Hayes	2 workshops

cont.

Hirschbuhl	see above
Schuyler	5-10 students, 1 hour per week seminar + home work
Smith	available from Education Department
Tidball	see above
Torr	see above

Zinn, Watts, Hall, Ojakangas, report informal seminars, public workshops from time to time.

	Yes
Advice and supervision for beginners	23

Usually described as informal, on an individual basis, numbers variable, occurring when a project has begun, preferably after (a) beginner's course(s).

Further comments

Deiss describes his course : -

'I offer a self-paced short course on authoring and instructional design to augment PLATO system lessons. Sometimes groups, sometimes individual. Readings, TV tapes, AVA lessons, CAI lessons, small group discussions.'

Sherwood describes TUTOR course : -

'A staff member shows the participant how to sign on and use basic editor functions. Then the new author works through 'Introduction to TUTOR' plus related on-line TUTOR lessons.
Consultancy is also available through the terminal. There are extensive on-line reference materials, also 'The TUTOR Language' for advanced authors.'

U.S.A. IV. Training of non-specialists and consultancy services (cont.)

2. Further consultancy

	Yes	No
Problems of computer implementation	21	5

Comments from 'Yes' group.

Several such as :

- I am available for consultancy, but I don't get much business!
- consultants always on duty.

cont.

- we have one programmer, who tries to help everybody.
- programming staff assigned to a project for its duration.

Schuyler - HYPERTUTOR provides telephone service to 10 user instructions for implementation "bugs".

Comments from 'No' group.

Several - we don't burden faculty with programming problems - programming done by graduate assistants/ programming analysts.

	Yes	No
Instructional design	21	5

'Yes'

Several - educational resources staff (instructional associates always available)

'No'

Several - we assist the faculty member in the writing, and participate in the development of the program and the instructional design.

	Yes	No
Evaluation	16	10

'Yes'

Several - by request

Downing - my own research on CAI and motivation of students

Schuyler - informal only.

'No'

Tidball - I am interested in this, but it's difficult to get paid for it!

Hayes - we haven't done much with formal evaluation, since most professors think they know a program is good or not.

U.S.A. V. Courseware Development

1. Decision basis for topic selection

Who decides?

1	CAI group director + faculty
4	CAI staff + faculty
1	committee + individual faculty
11	individual faculty

Criteria

1. No limitations (3)
   - Now, everyone is encouraged. A limit would occur if there was a large increase in terminal hours, and a need to upgrade the system.
   - I have not yet been very selective about what we put on the computer. It's hard enough to get people to put anything on at all.
2. Faculty commitment to use materials in their courses (4)
3. Materials solve a current learning problem (2)
4. Material conforms to a particular educational model (3)
   - material has a tight logical structure
   - physiological and clinical simulations
   - contributes to comprehensive test item bank which students can use for review.
5. Materials considered amenable to computer presentation (4)
   - pointless if CAI to be used as a page turner
   - we don't put stuff on the computer unless there's a damn good reason.
6. Service courses / courses with large student members (2)
7. Cut costs (2)
   - courses that are expensive to teach
   - replace expensive lab sessions.
8. Based on needs (3)

Comments such as 'courses developed commensurate with demand shown by faculty and students' which cannot be classified in 1-7.

Several projects indicate that they use a check list.

Tidball comments : -

'This is a very new field - different groups approach the problem in different ways. No universally successful ways have emerged as yet. It depends on the personalities and enthusiasm of the teacher'.

Further comment

The criteria are likely to become more selective as a project becomes established. What may be justified in the early stages in terms of appreciation and experience may well be rejected in terms of cost or effectiveness at a later stage.

U.S.A. V. Courseware Development

2. Who constructs the packages?

	Yes	Occasionally
Teachers plus specialists	20	1

Comment

- 'programming itself often done by graduate students'
- 'teachers are supposed to design the lessons, and graduate students programme.CAI director helps. No-one asks him about lesson design. Left to graduate assistants, as faculty say they have no time'
- (Schuyler) - 'plus telephone consulting service'.

	Yes	Occasionally
Teachers alone	6	1

Comment

- (Schuyler) - 'we encourage this'
- 'rarely'.

	Yes	Occasionally
Teachers plus students	6	-

Comment

- 'teachers plus computer science students'
- 'graduate students and seniors'
- 'Basic Science faculty plus 1st and 2nd year students'
- (Bork) - 'teachers pedagogy, students programming, secretaries typing'

U.S.A. V Courseware Development

3. Who sets the package in courseware?

1. Faculty authors	3
CAI unit programmers	14
Comment - CAI lab technicians - unit programmers	
2. Students	2
Comment - have hired computer science and chemistry students to help graduate assistents	
3. Typists	2
Comment - typist types them into the computer	

4.1. Who evaluates the courseware developed?

1. External evaluation	2
Comment - outside evaluation group just starting	
2. Specialist staff in CAI group	3
Comment - staff with statistical training - educational psychologists	
3. Students and colleagues	5
Comment - students sometimes paid also faculty - like a book review	
4. Teachers who developed the package	4
Comment - plus specialist support	
5. Not much done	2
Comment - we haven't done much, since most professors think they can tell if a unit is working - until I can persuade faculty who evaluate courseware that objectives must be spelled out we can do little else except watch students go through the course.	

4.2. How? (there are some multiple entries)

1. Rigorous statistical analyses	2
Comment - comparison with control group	
2. Records of student responses and other programme events	4
3. (Pre)-Post achievement tests	6
4. Student usage and expressed interest	2
Comment - interview - 'book review'	
5. Student attitude questionnaire	2
6. Subjective evaluation by faculty	8
Comment - review, does it run, is content O.K., will students use it? - instructional effectiveness is a later question	
7. Nothing	8

4.3. With what results?

1. Rejection/revision explicitly stated	7
Comment - redesign of courses - ½ rejected, ½ modified - each frame considered in detail, each course as a whole - formative evaluation to faculty author	
2. Good	4
Comment - generally well received - mixed, generally positive	
3. Fairly good	3
Comment - instability of the system affects success - students upset if program doesn't accept good answers - no evidence computer teaches better	

U.S.A. VI. Expectations of computer based learning

1. Configuration Many multiple responses, with comparative comments, most of which quoted below.

Big stand-alone (CAI dedicated or mixed)	Stand-alone dedicated mini (or micro)	Computer in network
18	24	25
		- minis linked to large hosts which will compute courses to suitable word length for execution on a variety of minis in conjunction with video disk capabilities for television-like presentation
- most effective solution	- for special applications	- only for passive transfer of material
		- yes, with minis, and large system for complicated stuff
		- too soon to say; at present, networks have the edge
	- will increase dramatically	
- (Sherwood) - yes, for complex reasons. We'll only think differently when someone provides PLATO like services by other means		
	- minis, stand alone	- or in a network
		- networks effective for cost, teaching effectiveness, courseware development
	- is the trend →	but networks will continue to be developed, many of which will contain big stand-alone computers
	- probably	- yes, to access special programs reguiring large computer and frequent author modification and maintenance

- next 8 years big stand-alone time-sharing computers	- then development here plus delivery after 8 years	?
- obviously (PLATO IV)	- also (reference Bork)	- likely to include both minis in networks, dial-up communications, plus CDC's large network with many computers in tandem
- expect several, both dedicated and mixed, but progress will be slow because of capital expense	- there may be some attempts to put together PLATO like systems with mini or micro computers	- a must for small systems because of the need for a large data base of lesson material - My hunch is that CAI systems will take a turn towards distributed networks of stand-alone teaching machines because of economic and marketing advantages
- technology now tends to large stand-alone dedication		- this may change as technology evolves

- Talking in bursts to intelligent terminals with sufficient memory and logic to permit significant instruction. Terminal updated from CPU and files returned to CPU at end of session. Student switches out of CAI to calculation by appropriate logic.

- The modern educational environment will have access to all three. One must remain diverse. It is useless to perform large tasks on small machines. Computers will become more and more specialised in the future. My students access many different machines across the country, some small, some large.

- All three are likely, highly dependent on the situation. Sciences use minis for problem solving, professions and disciplines share course-work on networks.

U.S.A. VI - Expectations of computer based learning

2. Terminals

	Paper	V.D.U.	Plasma	T.V.
Yes	12	21	12	16
Possibly	2	2	3	3
No	2	-	4	2
	primarily for reports on student progress	major terminal of the near future	bright future if the cost comes down	will become the CAI display medium for the populace along with CAI-video-disk and laser technology
			yes, I see a real future for these	only with small, special purpose systems
	some	general	resolution not good enough	not unless modified for a keyboard, and then it's a CRT
	no future	the most popular	increasing in popularity	depends on success of TICCIT
		we consider V.D.U.'s best for medical teaching		
	useful for us, we need hard copy	will be used for testing purposes		great potential as they could be cheap and offer use of colour and graphics
				colour - very likely, large local processing capability, graphics essential
	will decline	will increase	although plasma panels will make inroads in CRTs within 10 years	
			if price <u>really</u> drops	no, unless, keyboard input can be improved plus display resolution
	continued use for many applications	better, low cost graphics are needed	an exciting possibility, but currently too expensive	mainly classroom monitoring of other terminals

cont.

Paper	V.D.U.	Plasma	T.V.

- should be more sophisticated than they now are - mixture plasma with graphics and hard copy needed

- we envisage flexible display panels which could either be plasma or TV with random access image projection and random access audio under program control.

- combination CRT and hardware terminal is most desirable at present

- TV is probably the ultimate answer, but not in the near future

- ultimately computer driven graphics will become more important. Photographic display is awkward. A notebook is cheaper and better. The best of audiovisual technology and CAI will merge. Perhaps the video disk will be the answer, but hard copy of graphics is important and so far only available with TECTRONICS (unless you use a polaroid camera).

either - Must be graphics - could be plasma panel or CRT refreshed from a bit map

- CRT terminals and in some cases hard copy duplicators or punters

- Torr (Gallaudet - , Liberal Arts College for the Deaf).

"I imagine we will exploit TV much more, routing captioned television and digital information to the same terminals, perhaps with single frame buffers to permit remote receipt and study of microfiche files. Also need for communication display from deaf person to deaf person."

U.S.A. VI. Expectations of computer based learning

3. Systems software

(multiple entries summarised as 'mixed')

Standard languages	CAI languages	mixed development
7	6	20
multiple recommend-ations for - APL, FORTRAN, Cobol, ASSEMBLER, PL/I, BASIC TUTOR, ALGOL	multiple recommend-ations for - Coursewriter III and APL, PILOT, MUMPS, SAIL, TUTOR, PLANIT	instructional languages will serve to construct the courseware computer logic. The video disk will present the content randomly under control of the course logic.
Fortran will be used a lot for CMI	much more sensible	
use of APL for CAI will increase OK for simulation, problem solving, CMI cumbersome for CAI	we have had experience with Coursewriter and doubt much future use in the current form. We are currently working with a PILOT-MUMPS configuration to test feasibility	cont.

Standard languages	CAI languages	mixed development
	inadequate	most likely form of development
	PLANIT has best set of CAI facilities for the author and student records	
	I anticipate that ultimately the capabilities of such languages - including ease of authoring - will dominate CAI	
	(several) present evaluation suggests TUTOR language and software best for CAI at the present time	
variety APL, FORTRAN with extensions	not PLANIT, with pre-processors and standard 'strategies'	

U.S.A. VI Expectations of computer based learning

Lesson style, development and interchange anticipated

4. Style

Test administration	Drill and practice	Simple techniques	Complex learning	Other
16	15	10	21	4 .text retrieval .patient simulation .games .tutorial use
will grow	will continue as major application		will be a novelty, secondary in importance until video capabilities become wide-spread	
	where appropriate		why not?	
			in medical education	
			involves the other three	
little popularity	continued popularity		limited	

Test administration	Drill and practice	Simple techniques	Complex learning
			we will continue to develop programs that use complex learning, since we are looking at the postgraduate level, subject matter is complex
			hopefully
			CAI is only valuable if it is used to deliver instruction in a manner not otherwise available. Hence, I would expect a great deal of very complex material to be created as CAI becomes more sphisticated.
	limited in medical education		problem solving and decision making via simulations
mastery learning			
			mostly case presentations for medical students
CMI will probably grow faster than CAI for a while		probably no computer necessary	this will grow simulations and learning games and text retrieval systems will probably be items of major concern
			gradual shift to complex learning

- there will be a continuation of CAI/CMI applications across all the examples identified. One of the easiest ways to get faculty members involved is to initiate test administration on line.
- all are necessary, but the easiest will be the most prevalent
- clearly a mixed situation, growing more mixed as 1) it is a better understood medium 2) computation is cheaper
- all will be used. The experts will gravitate around the more sophisticated styles, such as simulations, which present a new learning experience each time a student tries the program.
- the lesson style should be a pedagogical decision, and the computer system should be powerful enough to implement it

U.S.A. VI. Expectations of computer based learning

Lesson style, development and interchange (continued)

5. Development

	Individual	Team	Commercial company
Yes	14	26	7
Some/ Possibly	3	1	3
Little/ No	3	-	2
	individual teachers will work on their own lessons, but with a small group of peers collaborating on evaluation and standardization		companies will popularize courses which may be fairly good, but not as good as the team or individually constructed courses, which will, unfortunately, become the minority
		I have most hope for teachers working in a loose group	
		automated team of teacher, consultant and programmer. Computer program will interact with the teacher, collect the text, and produce a CAI program	most effective for narrow objectives, industrial applications and below university level (public schools etc.)
	not unless he knows everything	author + applications programmer + typist	variety - although CAI will favour team and commercial sources
		educators + CAI consultants	
	yes, especially as systems become more widely available	instructors, specialists + technicians	
		team approach probably best - faculty + curriculum design staff + CAI programmer. Separate peer review by faculty in same content area.	
	only students + very few isolated teachers will do this	subject matter experts with release time + several programmers to assist	doesn't seem much a company can do

cont.

institutes with similar aims 6	- between institutes developing lessons - facilitated by either government or commercial funding and sponsorship	between like institutions
centralized systems/ networks/ identical systems 11	- through national grids, not by mailing materials to scattered, dissimilar systems - the PLATO system already provides effective lesson interchange - TUTOR lesson exchange exists - no royalties - organisations like CONDUIT	with like systems
standardizing software 7	- standardization of computer languages and through the use of language translated software - micro programming, many CPUs, different system organisation - common computer languages - common mass storage devices	- avoid proprietary languages developed by a particular hardware vendor - Course-writer, TUTOR, Decal etc. PILOT and PLANIT are the 2 major languages that are implemented on various machines - the only universal mass storage devices are punched paper tape and punched card. ½" magnetic tape may be hardware compatible, but is not always software compatible. The flexible disk or disquette may eventually be helpful, but it is not universal yet by any means
at user level 4	- by personal acquaintance rather than institutional agreements - non-costly exchanges helped by some indexes - people of good will will cooperate	
	- difficult because of pride of authorship - incompatible hardware will always be a problem - nothing is stabilized at present, and won't be for the next 5 years, so the simpler, more portable the system, the better	

Individual (continued)

- I think individuals will have the greatest impact. One good teacher (perhaps part of a team) could in a few years develop a series of lessons that could be standardized and used nation-wide at a tremendous saving in educational cast.
- teams and companies are too expensive. Large numbers of available terminals will attract volunteer authors who will compete much as text-book authors compete. Many physics books are written, few are published, fewer still are good. This 'natural selection' is simpler and cheaper than guided curriculum development.
- ultimately CAI lessons are as individual as a faculty member's lectures. No faculty member will accept another person's material, so only the individual approach will survive. Team and commercial approaches must cost more. They are unlikely to find the mass market that will make them economically feasible.

U.S.A. VI Lesson style, development and interchange (continued)

6. Interchange

Where interchange of materials is likely to occur and how best facilitated.

(some multiple responses)

commercial companies/ computer companies	5	- special interest groups working with computer venders - lesson publishers, like book publishers, may be computer vender
clearing house/ publishing, distribution, documentation	8	- globally, by means of satellite and/or cable communication to and from sophisticated computer broadcast and receiving stations - by information about lessons being widely available - clearing house plus formalization of credit for authorship
users groups, conferences	3	

cont.

U.S.A. VI. Commitment and further free comment

General commitment to identified trends	4	- with the exception of stand-alone systems (which respondent predicted will give way to minis)
will probably leave the field	2	- due to boredom with slow rate of acceptance - except, I might work with complex learning
too difficult to say	4	- project too immature for comment - too difficult to estimate
system development	6	- PLATO IV - to a great extent the future of computers in education depends on it - currently developing all aspects of a CAI/CMI system which is as portable as we can make it - I want an environment where I can build better, cheaper, more available CAI system and write model programs. Currently working on the design of a small system to meet these goals. Unless there is a drastic change in university priorities how faculty spend their time, how they are rewarded for innovation in teaching, CAI/CMI will go the way of educational TV etc. There is much to be done, and much is possible, but bureaucracy resists change. Until that is solved, CAI/CMI will remain a pastime for a handful of teachers. One man can't change a university, and I have to do something where I can be effective. - development of mini computer
software	2	- development of PILOT/BASIC language - Coursewriter to PILOT translator
CAI/CMI in a production setting	4	- an effective CAI/CMI operation must be within the context of a total student-development system, to include diagnostic testing, program evaluation, advising and counselling, and computer operations - Health science simulations - adjunct use of CAI
fundamental research	2	- currently researching computer administered and scored admissible probability measures - also Bayesian methods - CAI on learner characteristics; CAI and non-traditional students

cont.

questionnaire difficult to answer	5	- too long - would have preferred structured items to check, put in rank order - but three who complained added 'Good Luck!' (Thanks, A.H.)

Further comments and general advice from well-established projects.

- Don't go into CAI without graphics
- Best to start with providing time-sharing computational terminals, stay away from CAI, and build up an appreciation for time-sharing terminal use. Alpha-numeric CAI can kill rather than stimulate interest.
- One of the most important factors is cost.
  There are many categories of expense
  1. Hardware
  2. System software
  3. Language support
  4. Courseware

  To minimize expense in one area, one inevitably increases it in another. The best fit for the environment must be sought.
  Fortunately, hardware is becoming less expensive. For the sake of reliability, multiple systems are essential. It is better to acquire two smaller processors and divide the load between them than to have a single larger, more powerful machine.
  The larger, the more complex the machine, the greater the likelihood of difficulty and downtime.
  If you can afford machines like the Interdata 7/32, PDP-10 or the HP 3000, you will be well served. Otherwise, a great deal can be done on 2 PDP-8's.
- Above all avoid single language systems such as PDP 11 running RSTS or HP-2000 F or Access. Although BASIC is useful at lower academic levels, it will not perform everything needed, and there are many advantages in being able to support different languages simultaneously.